The Relationship of *Coleomegilla maculata* (DeGeer) (Coleoptera:Coccinellidae) to the Cocoon of Its parasite *Perilitus coccinellae* (Schrank) (Hymenoptera:Braconidae)

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Abstract: Evidence is presented to indicate that clasping of the occupied cocoon of the parasitic wasp, *Perilitus coccinellae* (Schrank) by adult ladybird beetles, *Coleomegilla maculata* (DeGeer) is voluntary. There appears to be an attraction of the occupied cocoon for the adult beetle.

The braconid wasp, *Perilitus coccinellae* (Schrank) (Fig. 1) is a common parasite of many beetles, including a variety of Coccinellidae. The distribution, host records and ecology of this wasp have been studied in some detail by Balduf (1926), Smith (1953), Sluss (1968) and others. The adult wasp parasitizes adult or larval beetles (David and Wilde, 1973) and the larva feeds upon the fat bodies and gonads of its host. It emerges through the suture between posterior abdominal tergites, and upon emergence immediately spins a cocoon.

Many workers have noted that an adult beetle is often found clasping the cocoon of this parasite (Fig. 2). Several of them (e.g. Balduf, 1926; Smith, 1960) have noted that the larval wasp, as it spins its cocoon, often entangles the legs of the beetle, either by intent or by accident. Recent observations in our laboratory and in the field suggest that this interpretation is in error. The cocoon is often, if not always, attached to the substrate (usually a leaf) and the beetle clasps it voluntarily.

Our belief that the association of the adult beetle with the cocoon is voluntary is based upon studies of specimens observed or collected in a corn field near Fredonia, Chautauqua County, New York, from July to September, 1973. In the field, and later in the laboratory, we found adult beetles clasping a small cocoon, which, upon emergence of its occupant, proved to be that of *P. coccinellae*. Adults found clasping a cocoon usually died soon after emergence of the wasp, or even before emergence in a few cases. Several workers have reported that parasitized beetles survived, but we suspect that these reports are based on

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Fig. 1. *Perilitus coccinellae* (Schrank) Newly emerged adult.

cases in which the cocoon was clasped by a beetle other than the parasitized individual. Thus, after emergence of the wasp, the beetle was sufficiently healthy to leave the cocoon and go its way. Sluss (1968), tracing the life cycle of the parasite in *Hippodamia convergens* Guerin, reported that parasitized individuals died within 3 to 4 days of emergence of the wasp.

Three sorts of observations suggest that the association of the beetle with the cocoon is voluntary. First, we have observed adult beetles abandoning a cocoon, and we have found abandoned cocoons in the field. On two occasions, abandonment occurred while the pupa was still in the cocoon, but this occurred only while we were collecting and transporting beetles from field to laboratory, indicating that it resulted from disturbance. On a few other occasions, the beetle abandoned the cocoon after the emergence of the wasp. This would be impossible if the cocoon were attached to the beetle.

Second, we observed, on one occasion, one beetle clasping a cocoon and another beetle trying to grasp it from the other side. For some time, both beetles held the cocoon at opposite ends, but eventually the "intruder", which may have been unparasitized and hence stronger, took over the cocoon. This

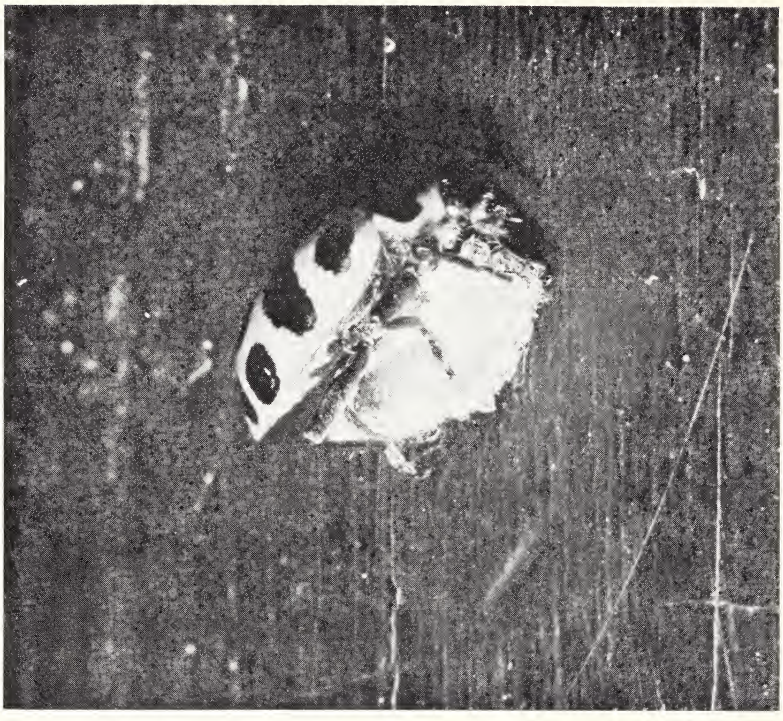

FIG. 2a. Lateral view of adult *Coleomegilla maculata* clasping a cocoon of *P. coccinellae*. Note both here and in Fig. 2b that the beetle's legs appear to be actively clasping the cocoon and that there is no noticeable entanglement of the legs in threads of the cocoon.

may explain previous observations that "parasitized" beetles lived after the parasite emerged.

Third, if the cocoon is indeed attached to the beetle by the larval wasp, it would not be attached to the substrate. We found, in the field, two cocoons* from which the wasp had emerged. Both were attached to corn leaves. In one case the attaching threads were primarily at one end, while the other cocoon was attached by threads which extended over the leaf in all directions. There was no doubt that the threads of the cocoon were firmly attached to the leaf. We were never able to find any evidence that a cocoon was actually attached to a beetle. We regularly observed beetles shifting their legs about on the cocoon, but their legs were never entangled to any significant degree.

It appears, therefore, that the clasping of the cocoon of *P. coccinellae* is a voluntary act on the part of adult *C. maculata*. The occupied cocoon seems to

* While this paper was in press, Mr. Jules Silverman conducted further field studies. He found numerous cocoons attached to corn leaves, several of them with dead beetles still clasping the cocoon.

Fig. 2b. Ventral view of adult *Coleomegilla maculata* clasping a cocoon of *P. coccinellae*.

have a positive attraction for the adult beetle, but this attraction is apparently lost when the wasp emerges. It would seem most likely that this attraction is chemical in nature, although we have thus far no direct evidence for this. Further olfactory experiments are planned.

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